UNITED
NATIONS

A

General Assembly

Distr.
GENERAL

A/CONF.151/PC/100/Add.22
17 December 1991

Original: ENGLISH

PREPARATORY COMMITTEE FOR THE UNITED NATIONS CONFERENCE ON ENVIRONMENT AND DEVELOPMENT
Fourth Session
New York, 2 March - 3 April 1992
Item 2 (c) of Plenary Session
Item 3 of provisional agenda of Working Group II

PREPARATIONS FOR THE UNITED NATIONS CONFERENCE ON ENVIRONMENT AND DEVELOPMENT ON THE BASIS OF GENERAL ASSEMBLY RESOLUTION 44/228 AND TAKING INTO ACCOUNT OTHER RELEVANT GENERAL ASSEMBLY RESOLUTIONS:

PROTECTION OF THE QUALITY AND SUPPLY OF FRESHWATER RESOURCES: APPLICATION OF INTEGRATED APPROACHES TO THE DEVELOPMENT, MANAGEMENT AND USE OF WATER RESOURCES

(Section II, Chapter 10 of Agenda 21)

Report of the Secretary-General of the Conference

INTRODUCTION

1. This document has been prepared by the Secretary-General of the Conference in response to decision 3/22 taken on 4 September 1991 at the third Preparatory Committee. It is based on the guidance provided by the Preparatory Committee on the structure of Agenda 21, as contained in decision 3/2 taken on 4 September 1991 at the third session of the Preparatory Committee. All text taken from document A/CONF.151/PC/WG.II/L.17/Revised are to be found nested between double asterisks (**‹), identifying where in the document it came from. Explanatory Notes are appended.

GE.91-62966/4044B
92-02644

2. **(WG.II/L.17/Rev./Paras. 1 to 14)< Effectively integrated management of water resources is important to all socio-economic sectors relying on water. Rational allocation prevents conflict and enhances the social development of local communities as well as economic planning and productivity. Efficient demand management allows water-using sectors to make long-term savings on water costs and stimulates resource-conscious production technologies. Health conditions and environmental quality should also improve either resulting from integrated development planning or as a beneficial consequence of improved environmental or social conditions.

Linkages to other Environmental and Developmental Issues:

3. Water is a finite resource, essential for the sustenance of life on earth. Virtually all the environmental issues listed in the United Nations General Assembly resolution 44/228 are directly or indirectly linked to freshwater issues. With increases in economic activities and the consequent potential for stress on ecosystems and natural resource stocks, the study and recognition of linkages between freshwater issues and other sectoral and cross-sectoral issues is becoming increasingly important. Socio-economic pursuit/including urbanization, industrial production and agricultural activities/has reached a stage where freshwater issues have often become the limiting factor for sustainable development. Freshwaters/rivers, reservoirs, lakes and ground waters [, polar ice mass and glaciers]/are in contact with other ecosystems and are used in a variety of human activities, many of which would not be possible without a freshwater supply of adequate quality and quantity.

4. Poor land-use management, including deforestation, non-sustainable agriculture, mining and urbanization, could lead to a considerable increase in erosion problems and related soil loss in the river basins. The sedimentation in large reservoirs may have serious adverse effects downstream by reducing the quantity of natural nutrients available to agricultural land or to coastal waters. The loss of nutrients can lead to increased fertilizer use and decreases in coastal fishery yields. Acidification of surface and some ground waters due to atmospheric deposition of air pollutants can lead to depletion of freshwater living resources, contributing to the loss of biodiversity. Construction of dams for hydropower and irrigation, water channelization, over-abstraction from aquifers, use of water bodies as open sewers for discharge of both domestic and industrial wastes can lead to salinization of rivers, lakes, and soils, salt intrusions in coastal aquifers, and serious water pollution problems. Should global warming occur as a result of climate change it would affect low-lying island freshwater resources and may affect the world's freshwater resources through [the melting of ice mass in the Arctic and Antarctic regions and] changes in the hydrologic cycle, resulting in changes in precipitation, with possible decreases in many areas of the Northern Hemisphere, accompanying decreases in soil moisture and annual river runoff. Even in the absence of global warming, natural variation in precipitation may be expected as in the past, resulting in periodic drought which can impact water availability, with consequent negative implications for economy and development. Because of these concerns, an integrated approach to freshwater management seems vital along with, for example, an integrated approach to pollution control, the optimal use of water and a holistic approach to the conservation of ecosystems.

5. [The existence of transboundary waters and their use is of significant importance to the riparian states concerned. In these circumstances it may be necessary for the concerned states to negotiate appropriate multilateral or bilateral agreements as relevant to ensure that riparian rights and practices should take into account the mutual interests of the parties concerned.]

6. Water-related diseases are still a major health problem, especially in the developing countries. Diseases caused by microbiological pollution of water supplies or transmitted by water-associated vectors, and those related to inadequate sanitation and absence of clean water, are widespread. With water use per capita expected to increase significantly in developing countries with high economic or population growth rates, the volume of waste requiring treatment is expected to present a growing problem. Likewise, the application of water-intensive production techniques and other high water-use consumption patterns are of concern in certain countries, particularly industrial ones. To ignore the interactions and linkages between freshwater issues and other sectoral issues could result in severe social, economic or human health consequences. Therefore, the provision of water supply and sanitation in developing countries is not only a vital ingredient of economic and social development but also an important element of environmental protection.

GENERAL OBJECTIVES

7. Water is a necessity of all life. The overall objective is to maintain the hydrological, biological and chemical functions of ecosystems to adapt human activities to the limits of nature's carrying capacity and to control water-related disease vectors.

8. Freshwater resources are an essential component of the earth's hydrosphere and an indispensable part of all terrestrial ecosystems. The freshwater environment is characterized by its hydrological regime including floods and droughts which, in some regions, have become more extreme and dramatic in their consequences in recent years. Global climate changes could also have their impact on freshwater resources and their availability and, through sea level rise, threaten coastal aquifers and small island ecosystems.

9. Freshwaters are a finite resource, not only indispensable for the sustenance of life on earth but also of vital importance to all socio-economic sectors. Development is not possible without considerable exploitation of water sources in relation to other land use activities and the control of deforestation and desertification. Priority must be given to the sustenance of land/water ecosystems, with particular attention to wetlands and biodiversity, and the satisfaction of basic human needs for drinking water, health protection and food security. For any water utilization beyond this, freshwater resources have to be considered as an economic good with an opportunity cost in alternative uses.

10. The Mar del Plata Action Plan, which emerged from the United Nations Water Conference in 1977, remains generally valid as the common basis for national and international action programmes in the freshwater sector. The review of progress achieved in its implementation and resulting strategies for the 1990s are reflected in Economic and Social Council resolution E/1991/85.

Agenda 21 in this sector, as presented hereunder, is based on these strategies, on the results of the Global Consultation on Safe Water and Sanitation for the 1990s, held at New Delhi in September 1990 (General Assembly resolution 45/181) and on the recommendations which may emerge from the International Conference on Water and the Environment in Dublin, January 1992, and on the results of the Preparatory Committee.

11. The wide-spread scarcity of freshwater resources, the progressive encroachment of incompatible activities and the gradual destruction of freshwater resources and their aggravating pollution in many world regions demands truly integrated water resources planing and management. The multi-sectoral nature of water resources development in the context of socio-economic development must be recognized as well as the multi-interest utilization of water resources for agriculture, industry, urban development, hydropower, inland fisheries, transportation, recreation and other activities. Rational water utilization schemes for the development of surface and underground water supply sources and other potential sources have to be supported by concurrent water conservation and wastage minimization measures.

12. Integrated water resources management necessitates appropriate mechanisms at the global, regional, national and local levels for implementing, coordinating and funding the related strategies and action programmes. Management of water resources should, as far as possible, take place in a river basin context (catchment level). [The options proposed by the International Conference on Water and the Environment/Development Issues for the 21st Century, held in Dublin, January 1992, has provided an input to identifying suitable implementation mechanisms.]

13. Capacity building is a prerequisite to integrated water resources management. Technical solutions will not achieve programme objectives on their own without suitable attention given to the human factor. The Symposium on a Strategy for Water Resources Capacity Building, held in Delft, June 1991, recognized the importance of capacity building for integrated and sustainable development of water resources at all levels. Capacity building consists of four basic elements:

a. creating an enabling environment with appropriate policy and legal frameworks;

b. institutional strengthening and development, including local community participation;

c. human resources development, including the strengthening of managerial systems and water users interests;

d. awareness building and education at all levels of society, [including inter alia, the consideration of a United Nations World Water Day].

14. [Adequate new and additional financial resources are indispensable for the effective utilization and protection of freshwater resources. Pursuant with the recognition of water as an economic good, but with priority to the satisfaction of basic needs, internal revenues have to be generated through

cost recovery schemes, water tariffs, taxes, etc. for uses implying productive activities, reflecting marginal and opportunity costs. In addition, external support will be required for water resources development from multilateral or bilateral sources (External Support Agencies) and from the private sector.]

15. Innovative technologies, including the improvement of indigenous techniques, are much needed to fully utilize limited water resources and to safeguard them against pollution. Implementation of Agenda 21 in the water sectors must therefore be supported by broad-based research and development programmes allowing for new technological solutions to be developed and field-tested. Technology [transfer on preferential and concessional terms] and [cooperation and diffusion] on all aspects of integrated water resources management is to be built into each programme area.>**

16. In accordance with the general objectives, the following Programme Areas are proposed for the freshwater sector:

A. Integrated Water Resources Development and Management

B. Water Resources Assessment

C. Protection of Water Resources, Water Quality and Aquatic Ecosystems

D. Drinking Water Supply and Sanitation

E. Water and Sustainable Urban Development

F. Water for Sustainable Food Production and Rural Development

G. [Impacts of Climate Change on Water Resources]

PROGRAMME AREAS

A. INTEGRATED WATER RESOURCES DEVELOPMENT AND MANAGEMENT

Basis for action

17. **(WG.II/L.17/Rev./Paras. 17 to 23)< The extent to which water resources development contributes to economic productivity and social well being is not usually appreciated although all social and economic activities rely heavily on the supply and quality of fresh water. As populations and economic activities grow, many countries are rapidly reaching conditions of water scarcity or face limits to economic development. Water demands are increasing rapidly, with 70-80% for irrigation, less than 20% for industry and a mere 6% for domestic consumption. The holistic management of water as a finite and vulnerable resource, and the integration of sectoral water plans and programmes within the framework of national economic and social policy is of paramount importance for action in the 1990s and beyond. The fragmentation of responsibilities for water resources development among sectoral agencies is proving, however, to be an even greater impediment to promoting integrated water management than had been anticipated. Effective implementation and coordination mechanisms are required not only at the national level but also at the inter-country and international levels.

Objectives

18. The overall objective is to satisfy the freshwater needs of countries for their economic and social development.

19. Integrated water resources management is based on water as an integral part of the ecosystem, a natural resource and an economic good, the quantity and quality of which determines its utilization. To this end, the availability and quality of water resources have to be protected, taking into account the functioning of aquatic ecosystems and the perennity of the resource in order to satisfy or reconcile water needs for human activities. In developing and using water resources, priority has to be given to the satisfaction of basic needs and the safeguarding of ecosystems. Beyond these requirements, however, water users should be charged its true marginal costs.

20. Integrated water resources management should be carried out at the catchment basin or sub-basin level, taking into account existing interlinkages between surface and ground waters. Four principal objectives should be pursued as follows:

a. to promote a dynamic, interactive, iterative and multi-sectoral approach to water resources management, including the identification and protection of potential sources of freshwater supply, which integrates technological, socio-economic, environmental and human health considerations

b. to plan the rational utilization, protection, conservation and management of water resources based on community needs and priorities and within the framework of national economic development policy

c. to design, implement and evaluate projects and programmes which are both economically efficient and socially appropriate within clearly defined strategies, based on a full public participatory approach, including the participation of women and indigenous peoples in water management policy-making and decision-making at the community level as well as at the national, regional and global levels

d. to identify and strengthen or develop, as required, in particular in developing countries, the appropriate institutional, legal and financial mechanisms to ensure that water policy and its implementation is a catalyst for sustainable social progress and economic growth.

21. The strengthening of national capacities to manage the resource and the role of government and local organizations in creating the enabling environment for efficient and equitable utilization of the resource are crucial. In the case of transboundary water resources there is an even greater need to formulate and harmonize water resources strategies and action programmes.

22. [Although difficult to measure success in this area, quantitative targets could realistically be set as follows:

By the year 2000:

a. all countries, in accordance with their capacities and resources available, will have designed and initiated costed and targeted national action programmes, and 75% of all countries will have appropriate institutional structures and legal instruments in place.

By the year 2025:

b. sub-sectoral targets of all freshwater programme areas will be reached.

It is understood that the fulfilment of the targets quantified in (a) and (b) above will depend upon new and additional financial resources that will be made available to developing countries in accordance with the relevant provisions of General Assembly resolution 44/228.]

Activities

23. [Countries, especially developing countries, according to their possibilities and with the assistance of relevant United Nations bodies and international donors, could implement the following activities to improve integrated water resources management in their countries:]

a. formulation of costed and targeted national action plans and investment programmes;

b. integration of measures for the protection and conservation of potential sources of freshwater supply, including the inventorization of water resources, with land-use planning, forest resource utilization and other relevant development activities;

c. development of interactive databases, forecasting methods and economic planning models;

d. optimisation of water resources allocation under physical and socio-economic constraints;

e. implementation of allocation decisions through demand management, pricing mechanisms and regulatory measures;

f. flood and drought management using risk analysis and environmental and social impact assessment;

g. promotion of schemes for rational water use through public awareness raising, educational programmes, levying of water tariffs and other economic instruments;

h. mobilization of water resources, particularly in arid and semi-arid areas;

i. promotion of international scientific research cooperation on freshwater resources;[1]

j. development of new and alternative sources of water supply such as seawater desalination, artificial groundwater recharge, use of marginal-quality water, wastewater reuse and water recycling;

k. integration of water quantity and quality management, including surface and underground water resources;

l. promotion of water conservation and wastage minimization schemes for all users, including the development of water-saving devices;

m. support to water users groups to optimize local water resources management;

n. development of public participatory techniques and their implementation in decision-making, particularly the enhancement of the role of women in water resources planning and management;

o. development and strengthening, as appropriate, of implementation mechanisms at all levels concerned:[2]

i. at the global level improved delineation of responsibilities, division of labour and coordination of international organizations and programmes;

[ii. at the regional level watershed-based organizations (river or lake basin authorities) and legal agreements for the joint management of transboundary water bodies;]

iii. at the national level integrated water resources planning and management in the framework of the national planning process, and where appropriate, establishment of independent regulation and monitoring of freshwater, based on national legislation and economic measures;

iv. at the [local/decentralized] level delegation of water resources management to the lowest appropriate level, including decentralization of government services to local authorities, private enterprises and communities

[p. elaboration, dissemination and application of operational guidelines in support of the implementation of national action plans and local water management schemes.]>**

Means of Implementation

Financing and Cost Evaluation:

24. During the period 1993 to 2000, an annual amount of about US$ 100 million of international financing is required to support national development in this programme area. The strengthening of international institutions in support of

the planning and initiation phases at the country level requires the allocation of about US$ 10 million per year. The transboundary and global freshwater issues require a financial support in the order of US$ 5 million annually for the executing of national, regional and global authorities and organizations. The total annual financing requirements in this programme area amount to US$ 115 million.[3]

Scientific and Technological Means:

25. The development of interactive databases, forecasting methods and economic planning models appropriate to the task of managing water resources in an efficient and sustainable manner will require the application of new techniques such as Geographic Information Systems and Expert Systems to gather, assimilate, analyze and display multi-sectoral information and also to optimize decision-making.[4] In addition, the development of new and alternative sources of water supply and low-cost water technologies will also require innovative applied research. This will involve the transfer of new techniques and technology to developing countries to be able to deal with the added dimension of integrating engineering, economic, environmental and social aspects of water resources management and the prediction of the effects of human impacts.[5]

26. Pursuant to the recognition of water as an economic good, the various available options for charging water users have to be further evaluated and field-tested, including domestic, urban, industrial and agricultural water user groups. Further development is required on economic instruments which take into account opportunity costs and environmental externalities. Field studies on the willingness to pay should be conducted in rural and urban situations.

Human Resources Development:

27. The delegation of water resources management to the lowest appropriate level necessitates the education and training of water management staff at all levels. Particular emphasis has to be placed on the introduction of public participatory techniques, including enhancement of the role of women. Skills related to various water management functions have to be developed also in the private sector, local/national NGOs, cooperatives, corporations and other water user groups.

Capacity Building:

28. Institutional capacity for water management should be developed when there is a clear demand. Existing administrative structures will often be quite capable of achieving local water resources management, but the need may arise for new institutions based upon e.g. river catchment areas, district development councils or local community committees. Although water is managed at various levels in the socio-political system, demand-driven management requires the development of water-related institutions at appropriate levels, taking into account the need for integration with land use management.

29. In creating the enabling environment for lowest appropriate level management, the role of government includes mobilization of financial and human resources, legislation, standard setting and other regulatory functions, monitoring and assessment of the use of water and land resources, and creating opportunities for public participation. International agencies and donors have an important role to play to support developing countries in creating the required enabling environment for integrated water resources management. This should include mechanisms to channel donor support to local levels in developing countries, including community-based institutions and NGOs.

B. WATER RESOURCES ASSESSMENT

Basis for action

30. **(WG.II/L.17/Rev./Paras. 25 to 28)< Water resources assessment (WRA), including the identification of potential sources of freshwater supply, is the continuing determination of sources, extent, dependability, and quality of water resources. It is the practical basis for their sustainable management and a prerequisite for evaluation of the possibilities for this development. There is, however, growing concern that at a time when more precise and reliable information is needed about water resources, hydrological services and related bodies are less able to provide this information, especially information on ground water and water quality. Major impediments are: the lack of financial resources for WRA, the fragmented nature of hydrological services and the insufficient numbers of qualified staff. At the same time the advancing technology for data capture and management is increasingly difficult to access for developing countries. Establishment of national data bases is, however, vital to WRA and for mitigating the effects of floods, droughts, desertification and pollution.

Objectives

31. Based upon the Mar del Plata Action Plan, this programme area is extended into the 1990s and beyond with the overall objective to ensure the assessment and forecasting of the quantity and quality of water resources, in order to estimate the total quantity of water resources available and their future supply potential, to reflect their current quality status, to predict possible conflicts between supply and demand and to provide a scientific data base for rational water resource utilization.

32. Five specific objectives are set accordingly as follows:

a. to make available to all countries water resource assessment technology which is appropriate to their needs, irrespective of their level of development, including methods for the impact assessment of climate change on freshwaters;

b. to have all countries, according to their financial means, allocate to water resource assessment financial resources in line with the economic and social needs for water resources data;

c. to ensure that the assessment information is fully utilized in the development of water management policies;

d. to have all countries establish the institutional arrangements needed to ensure the efficient collection, processing, storage, retrieval and dissemination to users of information about the quality and quantity of available water resources in an integrated manner;

e. to have sufficient numbers of appropriately qualified and capable staff recruited and retained by water resource assessment agencies, and provided with the training and retraining they need to carry out their responsibilities successfully.

33. [Quantitative programme targets can be set for the number of countries covered with adequate services:

a. by the year 2000 all countries, appropriate to their individual capacities and available resources, should have studied in detail the feasibility of installing water resources assessment services;

b. by the year 2000 there should be water resources assessment services with a high-density hydrometric network installed in 70 countries, and services with limited but adequate capacity in 60 countries;

c. by the year 2025 there should be 110 countries with fully developed services, and 40 countries with services of a limited capacity;

d. the longer-term target is to have fully operational services, based upon high-density hydrometric networks, available in all countries, appropriate to their individual capacities and available resources.]>**

Activities

34. [Countries, especially developing countries, according to their possibilities and with the assistance of relevant United Nations agencies, regional and international organizations and donor agencies, and through bilateral and multilateral agreement, should undertake the following activities]:

a. institutional framework

i. establish and strengthen the institutional capabilities of countries, including the legislative and regulatory arrangements, that are required to ensure the adequate assessment of their water resources and the provision of flood forecasting services;

ii. establish and maintain effective cooperation at the national level between the various agencies responsible for the collection, storage and analysis of hydrological data;

iii. establish and maintain effective cooperation between countries that is necessary for the assessment of the water resources of shared river basins and aquifers, and of the geographical regions extending over more than one country.

b. data systems[6]

i. review existing data collection networks and assess their adequacy, including those that provide real time data for flood forecasting;

ii. improve networks to meet accepted guidelines for the provision of data on water quantity and quality for surface and groundwater;

iii. apply standards and other means to ensure data compatibility;

iv. upgrade facilities and procedures used to store, process and analyze hydrological data and make such data and the forecasts derived from them available to potential users;

v. establish data bases, catalogues, year books and other means of informing users as to the availability of all types of hydrological data at national, regional and international levels;

vi. implement "data rescue" operations, e.g. establishment of national archives of water resources;

vii. implement appropriate well-tried techniques for the processing of hydrological data;

viii. derive area-related estimates from point hydrological data;

ix. assimilate remotely sensed data and the use, where appropriate, of geographical information systems.

c. data dissemination[7]

i. identify the need for water resources data for various planning purposes;

ii. analyze and present data and information on water resources in the forms required for planning and management of countries' socio-economic development, for use in environmental protection strategies and in the design and operation of specific water-related projects;

iii. provide forecasts and warnings of flood to the general public and civil defense.

d. research and development[8]

i. establish or strengthen research and development programmes at national, regional and international levels in support of water resource assessment activities;

ii. monitoring of research and development activities to ensure that they make full use of local expertise and other local resources and that they are appropriate for the needs of the country or countries concerned.

Means of Implementation

Financing and Cost Evaluation:

35. In order to attain the programme area targets as stated above by the year 2000, total average annual funding in the order of US$ 350 million is required, including contributions from external sources of US$ 140 million annually. The strengthening of international institutions for the development and exchange of information and technology requires about US$ 5 million per year. The total international financing needs for the years 1993 to 2000 for this programme area amount to US$ 145 million annually.[9]

Scientific and Technological Means:

36. The three most important research needs include: development of Global Hydrologic Models in support of analysis of climate change impact and of macroscale water resources assessment; closing the gap between terrestrial hydrology and ecology at different scales including the critical water-related processes behind loss of vegetation, land degradation and its restoration; study of the key processes in water quality genesis, closing the gap between hydrological flows and biogeochemical processes. The research models should build upon hydrological balance studies and also include the consumptive use of water.[10]

37. Water resource assessment necessitates the strengthening of existing systems for technology transfer and the development of new technology for use under field conditions. Prior to the above activities it is necessary to prepare catalogues of the water resources information held by government services, private sector, educational institutes, consultants, local water use organizations and others.

Human Resources Development:

38. Water resource assessment requires the establishment and maintenance of a body of well-trained and motivated staff sufficient to undertake the above activities. Education and training schemes have to be maintained at the national and/or regional levels designed to ensure an adequate supply of these trained personnel. In addition, the provision of attractive terms of employment and career paths for professional and technical staff should be encouraged. Human resources needs should be monitored periodically, including all levels of employment. Plans have to be established to meet these needs through education and training opportunities, and international programmes of courses and conferences.[11]

Capacity Building:

39. The conduct of water resource assessment on the basis of operational national hydrometric networks requires an enabling environment at all levels. National support action is necessary for enhanced national capacities:

a. review the legislative and regulatory basis of water resource assessment;

b. facilitate close collaboration between water sector agencies, particularly between information producers and users;

c. implement water management policies based upon realistic appraisals of water resource conditions and trends;

d. strengthen the managerial capabilities of water users groups to improve water use efficiency at the local level.

C. PROTECTION OF WATER RESOURCES, WATER QUALITY AND AQUATIC ECOSYSTEMS

Basis for action

40. **(WG.II/L.17/Rev./Paras. 31 to 35(h))< There are few regions of the world that are still exempt from problems of loss of potential sources of freshwater supply and of degraded water quality and the pollution of surface and groundwater sources. Major problems affecting the water quality of rivers and lakes arise from inadequately treated domestic sewage, inadequate controls on the discharges of industrial waste waters, the loss and destruction of catchment areas, siting of industrial plants, deforestation, uncontrolled shifting cultivation and poor agricultural practices, giving rise to the leaching of nutrients and pesticides. Aquatic ecosystems are disturbed and the living freshwater resources are threatened. Aquatic ecosystems are also affected by agricultural water resource development projects such as dams, river diversions, water installations and irrigation schemes. Erosion, sedimentation, deforestation and desertification have led to increased land degradation, and the creation of reservoirs has, in some cases, resulted in adverse effects on the food chain. Many of these problems have arisen from a development model which is environmentally destructive and from a lack of public awareness and education about surface and groundwater resource protection. Ecological and human health effects are the measurable consequences, although the means to monitor them are grossly inadequate or non-existent in many developing countries.

Objectives

41. Already the Mar del Plata Action Plan recognized the intrinsic linkage between water resource development projects and their important repercussions of a physical, chemical, biological, health and socio-economic nature. The overall environmental health objective was set:

"to evaluate the consequences which the various users of water have on the environment, to support measures aimed at controlling water-related diseases, and to protect ecosystems".

42. Three objectives will have to be pursued concurrently to integrate water quality aspects into water resource management:

a. maintenance of ecosystem integrity/a management principle to preserve aquatic ecosystems, including the living resources, and to protect them effectively from any form of degradation;

b. public health protection/a task requiring not only the provision of pathogen-free drinking water but also the control of disease vectors in the aquatic environment;

c. human resources development/a key to capacity building and a prerequisite for implementing water quality management.

43. [The following targets have been set to integrate water quality aspects into water resource management:

a. by the year 2000 all countries, appropriate to their capacities and resources available, should have identified all potential sources of water supply and prepared outlines for their protection, conservation and rational use;

b. by the year 2000 all countries should have effective water pollution control programmes, defined as enforceable standards for major point-source discharges and high-risk non-point sources, commensurate with their socio-economic development;

c. by the year 2000 all countries should participate, as far as appropriate, in inter-country and international water quality monitoring and management programs such as the Global Water Quality Monitoring Programme GEMS/WATER, UNEP's Environmentally Sound Management of Inland Waters, FAO's regional inland fishery bodies, and the RAMSAR Convention on Wetlands of International Importance especially as Waterfowl Habitat;

d. by the year 2025 the prevalence of water-associated diseases should be drastically reduced, starting with the eradication of dracunculosis (Guinea worm) by the year 2000 and onchocerciasis (river blindness) by the year 2000;[12]

e. by the year 2025 all countries should have established biological, health, physical and chemical quality criteria for all water bodies (surface and ground water) with a view to an ongoing improvement of water quality.]

Activities

44. [All countries, especially developing countries, according to their possibilities and with the assistance of appropriate United Nations agencies and other international organizations, regional economic cooperation organizations, and in cooperation with the industrialised countries could embark upon the following activities:]

a. Water resources protection and conservation

i. establishment and strengthening of technical and institutional capacities to identify and protect potential sources of water supply

ii. promotion and extension of the application of GIS and EIA

iii. identification of potential sources of water supply and preparation of national inventories

iv. preparation of national plans for water resources protection and conservation

v. strengthening of administrative and legislative measures to prevent encroachment into potentially usable catchment areas.

b. water pollution prevention and control

i. application of the polluter pays principle to all kinds of sources, including on-site and off-site sanitation

ii. promotion of the construction of treatment facilities for domestic sewage, drainage waters, industrial effluents, and the development of appropriate and indigenous technologies

iii. establishment of standards for the discharge of effluents and for the receiving waters

iv. introduction of the precautionary approach in water quality management

v. mandatory environmental impact assessment on all water resource development projects potentially impairing water quality and aquatic ecosystems, combined with a strengthened control of new industrial installations, solid waste landfills and infrastructure development projects

vi. enforcement of decisions based on risk assessment and risk management

vii. identification and application of best environmental practices to avoid diffuse pollution, i.e. through a limited, rational and planned use of nitrogenous fertilizers and other agrochemicals (pesticides, herbicides) in agricultural practices

viii. encouragement and promotion of adequately treated and purified wastewaters in agriculture, aquaculture, industry and other sectors.

c. development and application of clean technology

i. control of industrial waste discharges, including low-waste production technologies and water recirculation

ii. treatment of municipal wastewater for safe reuse in agriculture and aquaculture

iii. development of biotechnology for waste treatment, production of biofertilizers, etc.

iv. development of appropriate and indigenous methods for water pollution control.

d. groundwater protection

i. application of the necessary measures to mitigate saline intrusion into aquifers of small islands and coastal plains as a consequence of sea-level rise or of over-exploitation of coastal aquifers

ii. prevention of aquifer pollution through the establishment of protection zones in groundwater recharge and abstraction areas

iii. design and management of landfills based upon sound hydrogeological information and impact assessment, using best available technology

iv. mandatory water quality monitoring, on a permanent basis, of surface and groundwaters potentially affected by landfills.

e. protection of aquatic ecosystems

i. rehabilitation of polluted and degraded water bodies to restore aquatic habitats and ecosystems

ii. rehabilitation programmes for agricultural lands and for other users, taking into account equivalent action for the preservation and use of groundwater resources, important for agricultural productivity and for the biodiversity of the tropics

iii. conservation, in a balanced ecological and socio-economic framework, and protection of wetlands due to their ecological and habitat importance for many species as well as their socio-economic values

iv. control of noxious aquatic species which may destroy some other water species.

f. protection of freshwater living resources

i. control and monitoring of water quality to allow for the sustainable development of inland fisheries

ii. protection of ecosystems from pollution for the development of freshwater aquaculture projects.

g. monitoring and continuous surveillance of water resources and waters receiving wastes

i. establishment of networks for the monitoring and continuous surveillance of waters receiving wastes and of point and diffuse sources of pollution

ii. surveillance of all pollution sources to improve the compliance with standards and regulations and to regulate the issue of discharge permits

iii. monitoring of the utilization of chemicals in agriculture

iv. rational land use to prevent land degradation, erosion and siltation of lakes and other water bodies.

h. development of national and international legal instruments for water quality protection

The protection of the quality of water resources requires legal instruments, particularly for:

i. monitoring and control of pollution in national and transboundary waters

ii. control of long-range atmospheric transport of pollutants

iii. control of accidental and/or deliberate spills in national and/or transboundary water bodies

iv. environmental impact assessment.>**

Means of Implementation

Financing and Cost Evaluation:

45. Funds for pollution control have to be generated ultimately within each river basin and/or country through cost recovery and economic or fiscal instruments. The "polluter pays principle" (PPP) has to be adopted in conformity with the notion of water as an economic good. Total costs, including those financed nationally, are estimated at about US$ 1.0 billion annually for the period 1993 to 2000. Of this amount about US$ 330 million would be needed annually from international sources.[13]

46. The assessment of global environmental issues also includes water quality and aquatic ecosystems monitoring and assessment. River monitoring for global flux estimates is covered under programme area B already, and the necessary funds indicated there. About US$ 10 million annually would be needed in addition to this to strengthen international institutions. The total financing requirement for this programme area amounts to US$ 340 million annually.[14]

Scientific and Technological Means:

47. Countries should undertake cooperative research projects to develop solutions to technical problems which are appropriate for the conditions in each watershed or country. To this end research centres have to be developed and linked through networks, supported by regional water research institutes. The north-south twinning of research centres and field studies by international water research institutions should be actively promoted. It is important that a minimum percentage of funds for water resource development projects is allocated to research and development, particularly in externally funded projects.[15]

48. Monitoring and assessment of complex aquatic systems often require multi-disciplinary studies involving several institutions and scientists in a joint programme. International water quality programmes, such as GEMS/WATER, should be oriented towards the water quality of developing countries. User-friendly software, GIS and GRID methods should be developed for the handling, analysis and interpretation of monitoring data and for the preparation of management strategies.[16]

Human Resources Development:

49. Innovative approaches must be adopted for professional and managerial staff training in order to cope with changing needs and challenges. Flexibility and adaptability to emerging water pollution issues must be developed. Training activities should be undertaken periodically at all levels within the organizations responsible for water quality management, and innovative teaching techniques adopted for specific aspects of water quality monitoring and control, including development of training skills, inservice training, problem-solving workshops and refresher training courses.

50. Suitable approaches include the establishment of regional technical and engineering courses on water quality protection and control subjects at existing inter-country schools, and education/training courses for laboratory and field technicians, women and other water user groups for water resources protection and conservation.[17]

Capacity Building:

51. The effective protection of water resources and ecosystems from pollution requires considerable upgrading of most countries' present capacities. Water quality management programmes require a certain minimum infrastructure and staff to implement technical solutions and to enforce regulatory action. One of the key problems today and for the future is the sustained operation and

maintenance of these facilities. In order not to allow resources gained from previous investments to deteriorate further, immediate action is required in a number of areas.[18]

D. DRINKING WATER SUPPLY AND SANITATION

Basis for action

52. **(WG.II/L.17/Rev./Paras. 37 to 40)< Safe water supplies and environmental sanitation are vital for protecting the environment, improving health and alleviating poverty. An estimated 80% of all diseases and over one third of deaths in developing countries are caused through the consumption of contaminated water and on average as much as one tenth of each person's productive time is sacrificed to water-related diseases. Concerted efforts during the 1980s brought water and sanitation services to hundreds of millions of the world's poorest people. The most outstanding of these efforts is the launching in 1981 of the United Nations International Drinking Water Supply and Sanitation Decade (IDWSS) which resulted from the Mar del Plata Action Plan adopted by the United Nations Water Conference in 1977. The commonly agreed premise was that "all peoples, whatever their stage of development and their social and economic conditions, have the right to have access to drinking water in quantities and of a quality equal to their basic needs." The target of the IDWSS was to provide safe drinking water and sanitation to underserved urban and rural areas by 1990. But even the unprecedented progress achieved during this decade was not enough. One in three people in the developing world still lacks these two most basic requirements for health and dignity. It is also recognized that human excreta and sewage are the main causes of deterioration of water quality in developing countries, and the introduction of available technologies, including appropriate technologies, and the construction of sewage treatment facilities could bring significant improvement.

Objectives

53. The New Delhi Statement formalized the need to provide, on a sustainable basis, access to safe water in sufficient quantities and proper sanitation for all, requesting "some for all rather than more for some". Four Guiding Principles provide for the programme objectives:

a. protection of the environment and safeguarding of health through the integrated management of water resources and liquid and solid wastes;

b. institutional reforms promoting an integrated approach and including changes in procedures, attitudes and behaviour, and the full participation of women at all levels in sector institutions;

c. community management of services, backed by measures to strengthen local institutions in implementing and sustaining water and sanitation programmes;

d. sound financial practices, achieved through better management of existing assets, and widespread use of appropriate technologies.

54. Past experience has shown that specific targets should be set by each individual country. At the Summit for Children in September 1990, heads of state or government called for both universal access to water supply and sanitation and the eradication of guinea worm disease by 1995. Even for the more realistic target to achieve full coverage in water supply by 2025, it is estimated that annual investments must reach double current levels. One realistic strategy to meeting present and future needs, therefore, is to develop lower cost but adequate services that can be implemented and sustained at the community level.

Activities

55. [All countries, especially developing countries, according to their possibilities and with the assistance of appropriate United Nations agencies and other international organizations, and in cooperation with the industrialised countries could embark upon the following activities:]

a. the environment and health

i. establishment of protected areas for sources of water supply;

ii. sanitary disposal of excreta and sewage, using appropriate systems to treat wastewaters in urban and rural areas;

iii. expansion of urban and rural water supply;

iv. building and expansion, where appropriate, of sewage treatment facilities and drainage systems;

v. treatment and safe reuse of domestic and industrial wastewaters in urban and rural areas;

vi. control of water-associated diseases.

b. people and institutions

i. [strengthening the functioning of governments in water resources management and, at the same time, giving full recognition to the role of local authorities]

or:

ii. [encouraging decentralization and the part played by local authorities, private enterprises and NGOs]

or:

iii. [drawing attention of governments to the need for greater decentralization and for strengthening the role of local authorities, private enterprises and NGOs]

iv. human resources development at all levels, including special programmes for women;

v. broad-based education programmes, with particular emphasis on hygiene, local management and risk reduction;

vi. [international coordination mechanisms for programme funding and implementation].

c. national and community management

i. support and assist communities in managing their own systems on a sustainable basis;

ii. encouragement of [the local population, especially] women in water management;

iii. linkages between national water plans and community management of local waters;

iv. integration of community management of water in the context of overall planning;

v. promotion of primary health and environmental care at the local level, including training for local communities in appropriate water management techniques and primary health care;

vi. assisting service agencies to be more cost-effective and responsive to consumer needs;

vii. more attention to be given to underserved rural and low-income peri-urban areas;

viii. rehabilitation of defective systems, reduction of wastage and safe reuse of water and wastewater [through additional international financing];

ix. [programmes for operation and maintenance on the basis of cost recovery and charging mechanisms]

or:

x. [programmes for rational water use and ensured maintenance];

xi. research and development of appropriate technical solutions;

xii. [review of the criteria of financial assessment of drinking water and sanitation projects of multi-lateral credit organizations by taking into account mainly the environmental and social benefits of these projects];

xiii. [international efforts of solidarity by the developed countries with the developing countries in granting new and additional financial resources in accordance with resolution 44/228 in order to install treatment plants for urban waste waters].>**

d. awareness creation and public information/participation

i. strengthening of sector monitoring and information management at sub-national and national levels;

ii. annual processing, analysis and publishing of monitoring results at national and local levels as a sector management and advocacy/awareness creation tool;

iii. use of limited sector indicators at regional and global levels to promote the sector and raise funds;

iv. improve sector coordination, planning and implementation, with assistance of improved monitoring and information management, to increase the sector's absorptive capacity, particularly in community based self-help projects.

Means of Implementation

Financing and Cost Evaluation:

56. Accelerated development is necessary to reach the desired coverage of water supply and basic sanitation services by the year 2000. The rate of investment for the years until 2000 has, at least, to be doubled to a total of US$ 20 billion annually to achieve complete service coverage. The external component should be maintained at no less than one third of this, i.e. at about US$ 6.7 billion annually. The improved operation, maintenance and management of systems and the full utilization of the investments made requires the allocation of external support in the order of US$ 0.7 billion. The total external funding needs until the year 2000 are, therefore, US$ 7.4 billion annually.[19]

Scientific and Technological Means:

57. To ensure the feasibility, acceptability and sustainability of planned water supply services, adopted technologies must be responsive to the needs and constraints imposed by the conditions of the community concerned. Thus, design criteria involve technical, health, social, economic, provincial, institutional and environmental aspects which determine the characteristics, magnitude and cost of the planned system. Relevant international support programmes should address the developing countries concerning:

a. pursuit of low-cost scientific and technological means as far as practicable;

b. utilization of indigenous approaches as far as practicable, to maximise and sustain local involvement;

c. assistance to country-level technical/scientific institutes to facilitate curricula development to support fields critical to the water and sanitation sector.[20]

Human Resources Development:

58. To effectively plan and manage water supply and sanitation at the national, provincial, district and community level, and to most effectively utilize funds, trained professional and technical staff must be developed within each country in sufficient numbers. To do this countries must establish manpower development plans taking into consideration present requirements and planned developments. Subsequently, the development and performance of country-level training institutions should be enhanced so that they can play a pivotal role in capacity building. It is also important that countries provide adequate training for women in the sustainable maintenance of equipment, water resource management and environmental sanitation.

Capacity Building:

59. The implementation of water supply and sanitation programmes is a national responsibility. To varying degrees responsibility for the implementation of projects and the operating of systems should be delegated to all administrative levels right down to the community and individual served. This also means that national authorities together with the agencies and bodies of the United Nations system and other external support agencies in providing support to national programmes have to develop mechanisms and procedures to collaborate at all levels.[21] This is particularly important if full advantage is to be taken of community based approaches and self-reliance as tools to sustainability. This entails a high degree of community participation, involving women, in the conception, planning, decision-making, implementation and evaluation of projects for domestic water supply and sanitation.

60. Overall national capacity building at all administrative levels including institutional development, coordination, human resources, community participation, health and hygiene education, literacy, etc. have to be developed as fundamental to any efforts to improve health and socio-economic development through water supply and sanitation and their impact on the human environment. Capacity building should therefore be one of the underlying keys in implementation strategies. Institutional capacity building should be considered as equally important as sector supplies and equipment, so that funds can be directed to both aspects. This can be undertaken at the planning or programme/project formulation stage with clear definition of objectives and targets in this regard. In this respect technical cooperation among developing countries (TCDC) is crucial, due to available wealth of information and experience, and to avoid re-inventing the wheel. This has proven cost-effective in many country projects already.

E. WATER AND SUSTAINABLE URBAN DEVELOPMENT

Basis for action

61. **(WG.II/L.17/Rev./Paras. 42 to 45)< Early in the next century, more than half of the world's population will be living in urban areas. By 2025 that proportion will have risen to 60%, some 5 billion people.[22] Rapid urban population growth and industrialization are putting severe strains on the water resources and environmental protection capabilities of many cities.

Scarcity of freshwater resources and the escalating costs of developing new resources have a considerable impact on national industrial, agricultural and human settlement development and economic growth. Better management of urban water resources, including the elimination of unsustainable consumption patterns, can make a substantial contribution to the alleviation of poverty and improvement of the health and quality of life of the urban and rural poor. This situation is particularly serious in developing countries. A high proportion of large urban agglomerations are located around estuaries and in coastal zones, leading to pollution from municipal and industrial discharges combined with over-exploitation of available water resources and threatening the marine environment and the supply of freshwater resources.

Objectives

62. The development objective of this programme is to support local and central governments' efforts and capacities to sustain national development and productivity through environmentally sound management of water resources for urban use. Supporting this objective is the identification and implementation of strategies and actions to ensure the continued supply of affordable water for present and future needs, and to reverse current trends of resource degradation and depletion.

63. [Countries should strive to achieve by the year 2000:

a. All urban residents would have access to at least 40 litres per capita and day of safe water and 75% are provided with on-site or community facilities for sanitation.

b. All countries would establish and apply quantitative and qualitative discharge standards for municipal and industrial effluents.

c. 75% of solid waste generated in urban areas would be collected and recycled or disposed of in an environmentally safe way.][23]

Activities

64. [All countries, especially developing countries, according to their possibilities and through regional and international cooperation, and with the support of NGOs and the private sector, could undertake the following activities:]

a. protection of water resources from depletion, pollution and degradation

i. introduction of sanitary waste disposal facilities based on ecologically sound low-cost and upgradable technologies;

ii. implementation of urban storm water runoff and drainage programmes;

iii. promotion of recycling and reuse of waste-water and solid wastes;

iv. control of industrial pollution sources to protect water resources;

v. protection of watersheds from depletion and degradation of their forest cover and from harmful upstream activities;

vi. promotion of research into the contribution of forests to sustainable water resources development;

vii. limitation of the intensive use of agrochemicals with a view to minimizing their impact on water resources.

b. efficient and equitable allocation of water resources

i. reconciliation of city development planning with the availability and sustainability of water resources;

ii. satisfaction of the basic water needs of the urban population;

iii. introduction of water tariffs, where affordable, which reflect the marginal and opportunity cost of water, especially for productive activities.

c. institutional/legal/management reforms

i. adoption of a city-wide approach to the management of water resources;

ii. promotion at the national and local level of the elaboration of land use plans which give due consideration to water resources development;

iii. utilization of the skills and potential of non-governmental organizations and the private sector and local people, taking into account the public and strategic interests in water resources.

d. promotion of public participation

i. initiation of public awareness campaigns to encourage the public towards rational water utilization;

ii. sensitization of the public for the protection of water quality within the urban environment;

iii. promotion of public participation for the collection, recycling and elimination of wastes.

e. support to local capacity building

i. development of legislation and policies to promote investments in urban water and waste management reflecting the major contribution of cities to national economic development;

ii. provision of seed money and technical support to the local handling of materials supply and services;

iii. encouragement, to the extent possible, of autonomy and financial viability of city water, solid waste and sewerage utilities;

iv. creation and maintenance of a cadre of professionals and semi-professionals for water, wastewater and solid waste management.>**

f. provision of enhanced access to sanitary services

i. implement water, sanitation and waste management programmes focused on the urban poor;

ii. make low-cost water supply and sanitation technology choices available;

iii. base choice of technology and service levels on user preferences and willingness to pay;

iv. mobilize and facilitate the active involvement of women in water management teams;

v. encourage and equip local water association and water committees to manage community water supply systems and communal latrines, with technical backup available when required;

vi. rehabilitate existing malfunctioning systems and correct operation and maintenance inadequacies, before investing in new systems.

Means of Implementation

Financing and Cost Evaluation:

65. Total costs incurring for the installation of sewage collection and treatment facilities amounts to about US$ 9 billion annually, including about US$ 1.8 billion in external financing. The needs for urban drainage programmes are also about US$ 9 billion annually, including about US$ 2.3 billion in international funding. Operation and maintenance and related capacity building measures require about US$ 1.8 billion annually, including about US$ 0.4 billion in international financial support. The total external financing requirements amount to about US$ 4.5 billion annually.[24]

Scientific and Technological Means:

66. The 1980s saw considerable progress in the development and application of low-cost water supply and sanitation technologies. The programme envisages continuation of this work, with particular emphasis on development of appropriate sanitation and waste disposal technologies for low-income

high-density urban settlements. There should also be international information exchange, to ensure a widespread recognition among sector professionals of the availability and benefits of appropriate low-cost technologies. The public awareness campaigns will also include components to overcome user resistance to "second class" services, emphasizing the benefits of reliability and sustainability.

Human Resources Development:

67. Implicit in virtually all the elements of this programme is the need for progressive enhancement of the training and career development of personnel at all levels in sector institutions. Specific programme activities will involve the training and retention of staff with skills in community involvement, low-cost technology, financial management, and integrated planning of urban water resources management. Special provision is made for mobilizing and facilitating the active participation of women in water management teams, and for supporting the development of water associations and water committees, with appropriate training of treasurers, secretaries, caretakers, etc. Special education and training programmes for women should be launched with regard to the protection of water resources and water quality within urban areas.

Capacity Building:

68. In combination with human resources development, strengthening of institutional, legislative and management structures are key elements of the programme. A prerequisite for progress in enhancing access to water and sanitation services is the establishment of an institutional framework which ensures that the real needs and potential contributions of presently unserved populations are reflected in urban development planning. The multi-sectoral approach which is a vital part of urban water resources management requires institutional linkages at national and city levels, and the programme includes proposals for establishing inter-sectoral planning groups. Proposals for greater pollution control and prevention depend for their success on the right combination of economic and regulatory mechanisms, backed by adequate monitoring and surveillance.

69. Establishment of appropriate design standards, water quality objectives and discharge consents is therefore among the proposed activities. The programme also includes support for strengthening the capability of water and sewerage agencies, and for developing their autonomy and financial viability. Operation and maintenance of existing water and sanitation facilities has been recognized as a serious shortcoming in many countries. Technical and financial support is needed to help countries to correct present inadequacies and build up the capacity to operate and maintain rehabilitated and new systems.

F. WATER FOR SUSTAINABLE FOOD PRODUCTION AND RURAL DEVELOPMENT

Basis for action

70. **(WG.II/L.17/Rev., para. 47)< Sustainability of food production increasingly depends on sound and efficient water use and conservation practices consisting primarily of irrigation development and management

including water management in rainfed areas, livestock water supply, inland fisheries and agro-forestry. Rural development requires the integrated satisfaction of basic human needs for drinking water and for food production. While significant expansion of the area under rainfed agriculture has been achieved during the past decade, the productivity response and sustainability of irrigation systems have been constrained by problems of water-logging and salinization. Financial and market constraints are also a common problem. Soil erosion in the upstream watersheds, mismanagement and over-exploitation of the natural resources [in downstream watersheds] and acute competition for water, have all influenced the extent of poverty, hunger and famine in the developing nations. Soil erosion caused by overgrazing of livestock in uplands is also often responsible for the siltation of lakes. The development of irrigation schemes is most often not supported by environmental impact assessments identifying hydrological consequences within watersheds and due to interbasin transfers, nor by the assessment of social impacts on peoples in river valleys.>**

71. The non-availability of water supplies of suitable quality is a significant limiting factor to livestock production in many countries and improper disposal of animal wastes can in certain circumstances result in pollution of water supplies for both humans and animals. The drinking water requirements of livestock vary according to species and environment in which they are kept. It is estimated that the current global livestock drinking water requirement is around 60 billion litres a day and based on livestock population growth estimates, this daily requirement is predicted to increase by 0.4 billion litres per annum in the foreseeable future.

72. Freshwater fisheries in lakes and streams are an important source of food and protein. Fisheries of inland waters should be managed to maximize the yield of aquatic food organisms in an environmentally sound manner. This requires the conservation of water quality and quantity as well as the functional morphology of the aquatic environment. On the other hand, fishing and aquaculture themselves may damage the aquatic ecosystem and hence their development can only be perused subject to guidelines for impact limitation. Present levels of production from inland fisheries, both from fresh and brackish water, are around 7 million tons per year and could increase to 16 million tons per year by the year 2000; however, any increase in environmental stress could jeopardize this rise.

Objectives

73. **(WG.II/L.17/Rev./Paras. 48 and 49)< An International Action Programme on Water and Sustainable Agricultural Development (IAP-WASAD) has been initiated by FAO in cooperation with other international organizations. The main objective of the IAP-WASAD is to assist developing countries in planning, developing and managing water resources on an integrated basis to meet the present and future needs for agricultural production, taking into account environmental considerations.

74. The IAP-WASAD has developed a framework for sustainable water use in the agricultural sector and identified priority areas for action at national, regional and global levels. Quantitative targets for new irrigation development, improvement of existing irrigation schemes and reclamation of

waterlogged and salinized lands through drainage for 130 developing countries are estimated on the basis of food requirements, agro-climatic zones and availability of water and land.>**

75. The targets for irrigation, drainage and small-scale water programmes by the year 2000 for 130 developing countries are: (a) 15.2 million hectares of new irrigation development; (b) 12 million hectares of improvement/modernization of existing schemes; (c) 7 million hectares installed with drainage and water control facilities and (d) 10 million hectares of small-scale water programmes and conservation.

76. **(WG.II/L.17/Rev., para. 52)< The development of new irrigation areas at the above level may give rise to environmental concerns as this may imply the destruction of wetlands, water pollution, increased sedimentation and a reduction in biodiversity. Therefore, new irrigation schemes should be accompanied by an environmental impact assessment in case considerable negative environmental impacts are expected and also depending upon the scale of the scheme. Before developing new irrigation schemes, efforts should be made towards a more rational exploitation of existing schemes, including increased efficiency and productivity. Technologies for new irrigation schemes should be thoroughly evaluated, including their potential conflicts with other land uses. The active involvement of water users groups is a supporting objective.>**

77. The objectives with regard to water management for inland fisheries and aquaculture include conservation of water quality and quantity requirements for optimum production and prevention of water pollution by aquacultural activities. The action programme seeks to assist member countries in managing the fisheries of inland waters through the promotion of sustainable management of capture fisheries as well as the development of environmentally sound approaches to intensification of aquaculture.

78. The objectives with regard to water management for livestock supply are twofold: provision of adequate amounts and safeguarding of drinking-water quality in accordance with the specific needs of different animal species. This entails maximum salinity tolerance levels and the absence of pathogenic organisms. No global targets can be set due to large regional and intra-country variations.

Activities

79. **(WG.II/L.17/Rev., para. 54 (a) to (e))< [Countries, especially developing countries, according to their possibilities and with the support of the international community and cooperation of the private sector and NGOs, could undertake the following activities to protect their water resources from depletion and degradation:]

a. water use efficiency

i. increase of efficiency and productivity in agricultural water use for better utilization of limited water resources;

ii. strengthening of water and soil management research under irrigation and rainfed conditions;

iii. monitoring and evaluation of irrigation project performance to ensure, inter alia, the optimal utilization and proper maintenance of the project;

iv. support to water users groups with the aim to improve management performance at the local level;

v. supporting the appropriate use of relatively brackish water for irrigation.

b. waterlogging, salinity control and drainage

i. introduction of surface drainage in rainfed agriculture to prevent temporary waterlogging and flooding of lowlands;

ii. introduction of artificial drainage in irrigated and rainfed agriculture;

iii. encouragement of conjunctive use of surface and groundwaters, including monitoring and water balance studies;

iv. practising of drainage in irrigated areas of arid and semi-arid regions.

c. water quality management

i. establishment and operation of cost-effective water quality monitoring systems for agricultural water uses;

ii. prevention of adverse effects of agricultural activities on water quality for other social and economic activities and on wetlands, inter alia, through optimal use of on-farm inputs and the minimization of the use of external inputs in agricultural activities;

iii. establishment of biological, physical and chemical water quality criteria for agricultural water users and for marine and riverine ecosystems;

iv. prevention of soil run-off and sedimentation;

v. proper disposal of sewage from human settlements and of manure produced by intensive livestock breeding;

vi. minimize adverse effects from agricultural chemicals by use of integrated pest management;

vii. education of communities about the pollution impacts of the use of fertilizers and chemicals on water quality and food safety.

d. small-scale water programmes

i. development of small-scale irrigation, water supply for humans and livestock and for water and soil conservation;

ii. promotion of local initiatives for the integrated development and management of water resources;

iii. provision of adequate technical advice and support and enhancement of institutional collaboration at the local community level;

iv. [promotion of a technical farming approach for water management which takes account of the level of education, the capacity to mobilize local communities, and the ecosystem requirements of arid and semi-arid regions].

e. scarce water resources management

i. development of long-term strategies and practical implementation programmes for agricultural water use under scarcity conditions with competing demands for water;

ii. recognition of water as an economic and strategic good in irrigation planning and management;

iii. formulation of specialized programmes focused on drought preparedness with emphasis on food scarcity and environmental safeguards;

iv. promotion and enhancement of wastewater reuse in agriculture;

v. [encouragement of basin-wide cooperation in the integrated development of all types of transboundary water resources, taking into consideration the sovereignty of states and the equitable use of water resources].>**

f. water supply for livestock

i. improve quality of water available to livestock, taking into account their tolerance limits;

ii. increase the quantity of water sources available to livestock, and in particular those in extensive grazing systems in order to both reduce the distance needed to travel for water and to prevent overgrazing around water sources;

iii. prevent contamination of water sources with animal excrement in order to prevent the spread of diseases and in particular zoonosis;

iv. encourage multiple use of water supplies through promotion of integrated agro-livestock-fishery systems;

v. encourage water spreading schemes to increase water retention of extensive grasslands to stimulate forage production and prevent runoff.

g. inland fisheries

i. develop sustainable fishery management strategies within the framework of national and international water resources planning and monitor the implementation of such strategies;

ii. study specific aspects of the hydro-biology and environmental requirements of key inland fish species in relation to varying water regimes;

iii. prevent, mitigate or rehabilitate aquatic environments subjected to modification by other users for the sustainable use and conservation of biological diversity of living aquatic resources;

iv. develop and disseminate environmentally sound water resources development and management methodologies for the intensification of fish yield from inland waters;

v. establish and maintain adequate systems for the collection and interpretation of data on water quality, quantity and channel morphology related to management and the state of living aquatic resources including fisheries.

h. aquaculture development

i. develop environmentally sound aquaculture technologies that are compatible with local, regional and national water resources management plans and taking into consideration social factors;

ii. introduce appropriate aquaculture techniques and related water development and management practices in countries not yet experienced in aquaculture;

iii. assess environmental impacts of aquaculture with specific reference to commercialized culture units and potential water pollution from processing centres;

iv. evaluate economic feasibility of aquaculture in relation to alternative use of water, taking into consideration the use of marginal quality water and investment and operational requirements.

Means of Implementation

Financing and Cost Evaluation:

80. During the period 1983 to 2000, total annual costs for investments and technical support in this programme area are estimated in the order of about US$ 13.2 billion, of which about US$ 4.5 billion would have to come from international sources. This includes also about US$ 10 million annually to strengthen international, global and regional organizations.[25]

Scientific and Technological Means:

81. There is an urgent need for countries to monitor water resources and water quality, water and land use and crop production; compile inventories of type and extent of agricultural water development and their present and future contributions to sustainable agricultural development; evaluate the potential for fisheries and aquaculture development; and improve the availability and dissemination of data to planners, technicians, farmers and fishermen. Priority requirements for research are as follows:

a. identify critical areas for water-related adaptive research;

b. strengthen the adaptive research capacities of institutions in developing countries;

c. enhance translation of water-related farming and fishing systems research results into practical and accessible technologies and provide the support needed for their quick adoption at the field level.

82. Transfer of technology, both horizontal and vertical, needs to be strengthened. Mechanisms to provide credit, input supplies, markets, appropriate pricing and transportation must be developed jointly by countries and external support agencies. Integrated rural water supply infrastructure should be expanded for multiple uses and assist in developing the rural economy including facilities for water-related education and training and support services for agriculture.

Human Resources Development:

83. Training and human resources development should be actively pursued at the national level through: assessment of current and long-term human resources management and training needs; establishment of a national policy for human resources development; and initiation and implementation of training programmes for staff at all levels as well as for farmers. The necessary actions are as follows:

a. assess training needs for agricultural water management;

b. increase formal and informal training activities;

c. develop practical training courses for improving the ability of extension services to disseminate technologies and strengthen farmers' capabilities with special reference to small-scale producers;

d. train staff at all levels, including farmers, fishermen and members of local communities with particular reference to women;

e. increase the opportunities for career development to enhance the capabilities of administrators and officers at all levels involved in land and water management programmes.

Capacity Building:

84. The importance of a functional and coherent institutional framework at the national level to promote water and sustainable agricultural development has been generally fully recognized at present. In addition, an adequate legal framework of rules and regulations should be in place to facilitate actions on agricultural water use, drainage, water quality management, small-scale water programmes and the functioning of water users' and fishermen's associations. Legislation specific to the needs of the agricultural water sector should be consistent with, and stem from, general legislation for the management of water resources. Actions should be pursued in the following areas:

a. improve agricultural-, fisheries- and rural development-related water use policies and legal frameworks for implementing such policies;

b. review, strengthen and restructure, if required, existing institutions in order to enhance their capacities in water-related activities;

c. organizational structure, functional relationships and linkages among ministries and departments within a ministry;

d. specific measures that require support for institutional strengthening including long-term programme budgeting, staff training, incentives, mobility, equipment and coordination mechanisms;

e. enhance involvement of the private sector, where appropriate, in human resources development and provision of infrastructure;

f. transfer existing and new water use technologies by creating mechanisms for cooperation and information exchange among national and regional institutions.

G. IMPACTS OF CLIMATE CHANGE ON WATER RESOURCES

Basis for action

85. There is uncertainty in prediction of climate change at the global level; the uncertainties increase greatly at regional, national and local levels and yet it is at the national level that the most important decisions will need to be made. Higher temperatures or decreased precipitation will lead to decreased water supplies and increased water demands, and it may cause deterioration of the quality of freshwater bodies, putting strains on the already fragile balance between supply and demand in many countries. Even where precipitation might increase, there is no guarantee that it will occur at the time of year when it can be used and in addition there is a likelihood of increased flooding. Any rise in sea level will cause the intrusion of salt water in estuaries and coastal aquifers and on the flooding of low-lying coastal areas; this puts low-lying countries at great risk.

86. The Ministerial Declaration of the Second World Climate Conference (SWCC) states that "the potential impact of such climate change could pose an environmental threat of an up to now unknown magnitude; and could even threaten survival in some small island states and in low-lying coastal, arid and semi-arid areas." The conference saw that among the most important impacts of climate change will be its effects on the hydrological cycle and water management systems and, through these, on socio-economic systems. Increase in incidence of extremes, such as floods and droughts, would cause increased frequency and severity of disasters. The conference therefore called for a strengthening of the necessary research and monitoring programmes and the exchange of relevant data and information, these action to be undertaken at national, regional and international levels.

Objectives

87. The very nature of this topic calls first and foremost for more information about and greater understanding of the threat that is being faced. This may be translated into the following two objectives:

a. to understand and quantify the threat of the impact of climate change on freshwater resources by the year 2000;

b. to facilitate the implementation of effective national counter-measures, as and when the threatening impact is seen as sufficiently confirmed to justify such action.

Activities

88. Affected countries, especially developing countries, according to their possibilities and with the assistance of the international community, should develop programmes with the following purposes:

a. monitor the hydrological regime, including water quality, and related climate factors, especially in those regions and countries most likely to suffer from the adverse effects of climate change, where the localities vulnerable to these effects should be defined;

b. develop and apply techniques and methodologies for assessing the potential adverse effects of climate change, through changes in temperature, precipitation and sea-level rise on freshwater resources and the flood risk;

c. assess the resulting social, economic and environmental impacts;

d. develop and initiate response strategies to counter the adverse effects that are identified, including changing groundwater levels, and the mitigation of saline intrusion into aquifers;

e. contribute to the research activities underway within the framework of current international programmes.

Means of implementation

Financing and Cost Evaluation:

89. During the years 1993 to 2000, national programmes to assess and mitigate the effects of climate change will incur costs of about US$ 100 million annually, of which about US$ 40 million would have to come from international sources. Joint international research and case studies require additional US$ 4 million annually.[26]

Scientific and Technological Means:

90. Monitoring of climate change and its impact on freshwater bodies must be closely integrated with overall national and international programmes for monitoring the environment, in particular those concerned with the atmosphere, as discussed under other sections of Agenda 21, and with the hydrosphere as discussed under B above. The analysis of data for sign of climate change and as a basis for implementing measures to combat the threat is a specialized task that has yet to be refined to the level required. Extensive developmental work is necessary here and due account will be taken of the work of IPCC, IGBP and other relevant international programmes.

91. The development and implementation of response strategies requires innovative use of well-tried technological means and engineering solutions, including the installation of flood warning systems and the construction of new water-resource development projects such as dams, aqueducts, well fields, wastewater treatment plants, desalination works, levees, banks and drainage channels. There is also a need for coordinated research networks such as the IGBP/START network.

Human Resources Development:

92. The developmental work and innovation depend for their success on highly trained and motivated staff. International projects can help by enumerating alternatives, but each country needs to develop its own expertise in the scientific and engineering challenges to be faced, plus a body of dedicated individuals who are able to interpret the complex issues concerned for those required to make policy decisions. These specialized personnel need to be trained, hired and retained in service where they can serve their countries in these tasks.

Capacity Building:

93. There is a need, however, to build a capacity at the national level to develop, review and implement response strategies. Construction of major engineering works and installation of forecasting systems will require significant strengthening of the agencies responsible, whether in the public or the private sector. Most critical is the requirement for a socio-economic mechanism which can review predictions of the impact of climate change and possible response strategies and make the necessary judgements and decisions. These may necessitate the re-zoning of land and the re-allocation of financial resources, and could involve major legislation affecting taxes and individual and corporate rights as well as research programmes such as Human Response to Global Change.

EXPLANATORY NOTES

1. See also chapter IV.3 on Science for sustainable development.

2. See also chapter IV.6 on International institutional arrangements and chapter IV.8 on International legal instruments and mechanisms.

3. When estimating the financial requirements for integrated water resources management it has to be kept in mind that the bulk of investments and external donor support is covered under the programme areas D, E and F.

4. See also chapter IV.9 on Providing data and information for sustainable development.

5. See also chapter IV.2 on Transfer of environmentally sound technology.

6. See also chapter IV.9 on Providing data and information for sustainable development.

7. See also chapter IV.9 on Providing data and information for sustainable development.

8. See also chapter IV.3 on Science for sustainable development.

9. Financial support is required primarily for the establishment and strengthening of national hydrometric networks, also covering transboundary watercourses.

10. See also chapter IV.3 on Science for sustainable development.

11. See also chapter IV.4 on Promoting of education, training and public awareness.

12. Activities towards this target are included in chapter I.6 on Protection of human health conditions.

13. These costs are estimated for the establishment of legal, regulatory, institutional and technical measures to control water pollution.

14. Costs for erosion control, sewage treatment and infrastructure measures are contained in the relevant chapters of Agenda 21.

15. See also chapter IV.3 on Science for sustainable development.

16. Specific research and development subjects in this programme area should include:

a. development of low-cost biological monitoring techniques to obtain an integrated view of environmental pollution impacts;

b. study of distribution and pathways of inorganic and organic micro-pollutants, particularly agrochemicals, in aquatic ecosystems;

c. ecotoxicological studies of the long-term effects of particularly harmful chemicals on aquatic biota;

d. simplified mathematical models of water quality for management purposes;

e. field-testing of appropriate waste and pollution control technologies;

f. promoting the application of economic instruments and fiscal incentives for the control of water pollution sources;

g. establishing emergency control and response strategies, including contingency plans, for dealing with the treatment and clean-up of accidental spillages.

17. See also chapter III.1 on Women.

18. Specific capacity building activities are:

a. establishment and strengthening of institutional frameworks at national and local levels, including technical infrastructure for water quality monitoring, assessment and control, standard setting, issuing of permits and effective enforcement at the national and local level;

b. dissemination of information to water users at all levels on, inter alia, ecosystems, the water cycle, water quality protection, source control measures and water-borne disease control;

c. awareness building on ecological and water quality issues at all levels;

d. maintenance of laboratory equipment through regular servicing of instruments, repair of malfunctioning equipment and advance procurement of essential spares;

e. development of water quality assessment capabilities of water management authorities through cooperative studies or twinning arrangements;

f. operation and maintenance of water pollution control installations, including regular efficiency verification, advance procurement of essential spare parts and regional coordination of manufacturing services;

g. establishment of a permanent, multi-sectoral follow-up evaluation mechanisms for the planning and management of water resource developments, including hydrological as well as water quality aspects.

19. The New Delhi Statement concludes that "if costs were halved and financial resources at least doubled, universal coverage could be within range by the end of the century." (See also United Nations General Assembly resolution A/RES/45/181.)

20. See also chapters IV.2 on Transfer of environmentally sound technology and IV.4 on Promoting of education, training and public awareness.

21. See also chapter IV.5 on Capacity building in developing countries.

22. See also chapter I.7 on Promoting a sustainable pattern of human settlements.

23. See also chapter II.13 on Environmentally sound management of solid wastes.

24. Cost estimates for drinking water supply and basic sanitation in rural areas are already included in programme are D.

25. The cost estimates for water-based agricultural development activities include irrigation schemes, rainfed agriculture, livestock supply, inland fisheries and aquaculture in a total of 130 developing countries.

26. The impacts of climate change on freshwaters are costed with regard to sea level rise, droughts and increased flood risks.